MT-3109
AC/DC Digital Clamp Multimeter

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User's Manual

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MT-3109 AC/DC Digital Clamp Multimeter

Overview

This Operating Manual covers information on safety and cautions. Please read the relevant information carefully and observe all the Warnings and Notes strictly.

⚠ Warning

To avoid electric shock or personal injury, read the “Safety Information" and "Rules for Safe Operation" carefully before using the meter. Digital Clamp Multimeter Model (hereafter referred to as "the Meter") is 3 3/4 digits with steady operations, fashionable structure and highly reliable measuring instrument. The Meter uses large scale of integrated circuit with double integrated A/D converter as its core and has full range overload protection

The Meter can not only measure AC/DC Voltage, AC/DC Current, Frequency, Duty Cycle, Resistance, Diodes, Continuity but also it has Data Hold, Sleep Mode and Relative Mode features.

Unpacking Inspection

Open the package case and take out the Meter. Check the following items carefully to see any missing or damaged part:

Item	Description	Qty
1	User’s manual	1 piece
2	Test Lead	1 pair
3	Test Clip	1 pair
4	Carrying Bag	1 piece

In the event you find any missing or damage, please contact your dealer immediately.

Safety Information

This Meter complies with the standards IEC61010: overvoltage category (CAT.II 600V) and double insulation.

CAT. II: Local level, appliance, PORTABLE EQUIPMENT etc., with smaller transient over voltages than CAT.III

CAT. III: Distribution level, fixed installation, with smaller transient over voltages than CAT. IV

Use the Meter only as specified in this operating manual, otherwise the protection provided by the Meter may be impaired. In this manual, a Warning identifies conditions and actions that pose hazards to the user, or may damage the Meter or the equipment under test. A Note identifies the information that user should pay attention to International electrical symbols used on the Meter and in this Operating Manual are explained on page

Rules for Safe Operation

⚠ Warning

To avoid possible electric shock or personal injury, and to avoid possible damage to the Meter or to the equipment under test, adhere to the following rules:

- Before using the Meter inspect the case. Do not use the Meter if it is damaged or the case (or part of the case) is removed. Look for cracks or missing plastic. Pay attention to the insulation around the connectors.
- Inspect the test leads for damaged insulation or exposed metal. Check the test leads for continuity. Replace damaged test leads with identical model number or electrical specifications before using the Meter.
- Do not apply more than the rated voltage, as marked on the Meter, between the terminals or between any terminal and grounding If the value to be measured is unknown, use the maximum measurement position and reduce the range step by step until a satisfactory reading is obtained
- When measurement has been completed, disconnect the connection between
- The test leads and the circuit under test, remove the testing leads away from the input terminals of the Meter and turn the Meter power off.

- The rotary switch should be placed in the right position and no any changeover of range shall be made during measurement is conducted to prevent damage of the Meter.

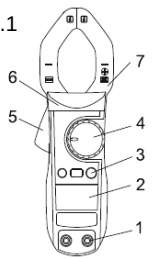
- Do not carry out the measurement when the Meter's back case and battery compartment are not closed to avoid electric shock.
- Do not input higher than 600V between the two Meter's input terminal to avoid electric shock and damages to the Meter.
- When the Meter working at an effective voltage over 60V in DC or 30V rms in AC, special care should be taken for there is danger of electric shock.
- Use the proper terminals, function, and range for your measurements.
- Do not use or store the Meter in an environment of high temperature, humidity, explosive, inflammable and strong magnetic field. The performance of the Meter may deteriorate after dampened.
- When using the test leads, keep your fingers behind the finger guards.
- Disconnect circuit power and discharge all high-voltage capacitors before testing resistance, continuity and diode.
- Replace the battery as soon as the battery indicator appears. With a low battery, the Meter might produce false readings that can lead to electric shock and personal injury.
- When servicing the Meter, use only the same model number or identical electrical specifications replacement parts.
- When servicing the Meter, use only the same model number or identical electrical specifications replacement parts.
- The internal circuit of the Meter shall not be altered at will to avoid damage of the Meter and any accident.
- Soft cloth and mild detergent should be used to clean the surface of the Meter when servicing. No abrasive and solvent should be used to prevent the surface of the Meter from corrosion, damage and accident.
- The Meter is suitable for indoor use.
- Turn the Meter off when it is not in use and take out the battery when not using for a long time.
- Constantly check the battery as it may leak when it has been using for some time, Replace the battery as soon as leaking appears. A leaking battery will damage the Meter.

International Electrical Symbols

~	AC (Alternating Current)
⎓	DC (Direct Current)
≂	AC or DC
⏚	Grounding
⧈	Double Insulated
⚠	Warning. Refer to the Operating Manual
⊟	Deficiency of Built-In Battery
•))	Continuity Test
⊣◁	Diode
⊣⊢	Capacitance Test
▭	Fuse
CE	Conforms to Standards of European Union

The Meter Structure (see figure 1)

figure.1



1. Input Terminals
2. LCD Display
3. Functional Buttons
4. Rotary Switch
5. Trigger: press the lever to open the transformer jaw
6. Hand Guards: to protect user's hand from touching the dangerous area.
7. Transformer Jaw: designed to pick up the AC and DC current flowing through the conductor. It could transfer current to voltage. The tested conductor must vertically go through the Jaw center.

Rotary Switch

Below table indicated for information of rotary switch positions.

Rotary Switch Position	**Function**
OFF	Power is turned off
V ≂	AC or DC voltage measurement
Ω	Resistance measurement
⊣⊢/ •))	⊣⊢ : Diode test •)) : Continuity test
Hz / Duty %	Frequency Measurement and Duty Measurement
⊣(	Capacitance test range from 40.OOnF to 1OO.OuF
40A ≂ & 400A ≂	AC and DC current measurement range

Functional Buttons

Below table for information of functional button operations.

Button	Operation Performed
HOLD	● Press **HOLD** to enter the Hold mode in any mode, the Meter beeps. ● Press **HOLD** again to exit the Hold mode, the Meter beeps.
ELA	**At V≂ and Ω range:** •Press select manual ranging measurement mode. The Meter is default to auto ranging measurement mode. •When the Meter is at manual ranging measurement mode, press to step down the range. **At A≂ range:** •Press enter to the REL mode. It subtracts a stored value from the present measurement value and displays a result. **At Hz/Duty% range:** Press switch to between Hz measurement mode and Duty % measurement mode.

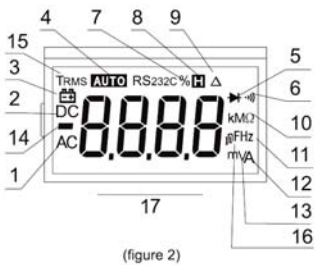
Button	Operation Performed
Select	•Press SELECT button to select the alternate functions marked in blue color on the Meter's faceplate including Hz, Duty%, V≂, ⊣+ •))), 40 A≂, and 400 A≂ . •After the Meter entering Sleep Mode, press and hold SELECT to turn the Meter on, it will disable the Sleep Mode feature.

The Effectiveness of Functional Buttons

Not every functional buttons can be used on every rotary switch positions. Below table describe which functional buttons can be used on which rotary switch positions

Rotary Switch Positions	Functional Buttons		
	SELECT	RELA	HOLD
V≂	●	●	●
Ω	N/A	●	●
⊣+ / •)))	●	N/A	●
Hz / Duty%	N/A	●	●
40 A≂	●	●	●
400 A≂	●	●	●
⊣+	N/A	●	●

Display Symbols (see figure 2)



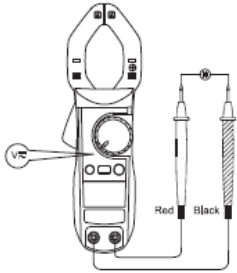
(figure 2)

MT-3109 AC/DC Digital Clamp Multimeter

No.	Symbol	Meaning
1	AC	Indicator for AC voltage or current
2	DC	Indicator for DC voltage
3		The battery is low. Warning: To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator appears.
4	AUTO	The Meter is in the auto range mode in which the Meter automatically selects the range with the best resolution.
5		Test of diode
6		The continuity buzzer is on
7	%	Indicator for Duty.
8	H	Data hold is active
9		Indicator for REL mode
10	**Ω,KΩ, MΩ**	Ω: Ohm. The unit of resistance. kΩ: Kilohm. $1x10^3$ or 1000 ohms MΩ: Megohm. $1x10^6$ or 1,000,000 ohms
11	**Hz**	The unit of Frequency
12	**A**	Amperes (amps). The unit of current.
13	**mV, V**	Volts. The unit of voltage. mV: Millivolt. $1xl0^{-3}$ or 0.001 volts
14		Indicates negative reading
15	**TRMS**	Indicator for TRMS mode
16	**F,nF,uF,**	Farad. The unit of capacitance.
17	**OL**	The input value is too large for the selected range

Measurement Operation

A. DC/AC Voltage Measurement (see figure 3)



(figure 3)

⚠ Warning

To avoid harms to you or damages to the Meter from electric shock, do not attempt to measure voltages higher than 600V AC/DC, although readings may be obtained

The DC Voltage ranges are: 400mV, 4V, 40V, 400V and 600V.

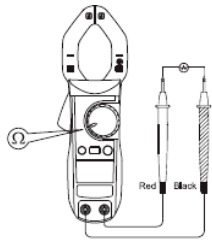
The AC Voltage ranges are: 4V, 40V, 400V and 600V.

To measure DC voltage, connect the Meter as follows:

(1) Insert the red test lead into the Hz Duty% terminal and the black test lead into the COM terminal.
(2) Set the rotary switch to . DC measurement mode and auto ranging is a default.
(3) Press SELECT to switch to AC measurement mode or press REL to switch to manual ranging measurement mode.
(4) Connect the test leads across with the object being measured. The measured value shows on the display.

Note

A. When DC/AC voltage measurement has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.
B. Measuring Resistance (see figure 4)



(figure 4)

⚠ Warning

To avoid damages to the Meter or to the devices under test, disconnect circuit power and discharge all the high-voltage capacitors before measuring resistance.

The resistance ranges are:
400Ω, 4kΩ, 40kΩ,400kΩ,4 MΩ and 40MΩ.
To measure resistance, connect the Meter as follows:

1. Insert the red test lead into the Hz Duty% terminal and the black test lead into the COM terminal.
2. Set the rotary switch to Ω. Resistance measurement is default to auto range mode, press RELA to switch to manual ranging measurement mode.
3. Connect the test leads across with the object being measured. The measured value shows on the display.

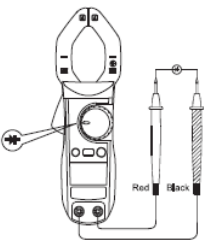
Note

- To obtain a more precise reading, you could remove the objects being tested from the circuit when measuring,
- When resistance measurement has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

C. Testing Diodes (see figure 5)

⚠ Warning

To avoid damages to the Meter or to the devices under test, disconnect circuit power and discharge all the high-voltage capacitors before testing diodes.



(figure 5)

Use the diode test to check diodes, transistors, and other semiconductor devices. The diode test sends a current through the semiconductor junction, then measure the

voltage drop across the junction. A good silicon junction drops between 0.5V and 0.8V.

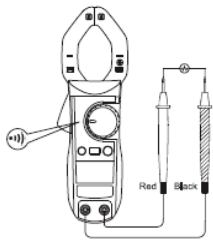
To test the diode out of a circuit, connect the Meter as follows:

1. Insert the red test lead into the Hz Duty% -i))-H VQ terminal and the black test lead into the COM terminal.
2. Set the rotary switch to . Diode measurement mode is a default or presses SELECT to select measurement mode.
3. For forward voltage drop readings on any semiconductor component, place the red test lead on the component's anode and place the black test lead on the component's cathode.

Note

- To obtain a more precise reading, you could remove the objects being tested from the circuit when measuring.
- When diode testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

D. Testing for Continuity (see figure 6)



(figure 6)

⚠ Warning

To avoid damages to the Meter or to the devices under test, disconnect circuit power and discharge all the high-voltage capacitors before measuring continuity.

To test for continuity, connect the Meter as follows:

1. Insert the red test lead into the Hz Duty% terminal and the black test lead into the COM terminal.
2. Set the rotary switch to and press SELECT button to select measurement mode. The buzzer sounds if the resistance of a circuit under test is less than 50Ω

3. The buzzer may or may not sounds if the resistance of a circuit under test is between 50Ω to 100Ω
4. The buzzer does not sound if the resistance of a circuit under test is higher than 100Ω

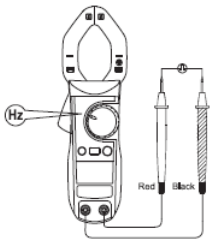
Note

- When continuity testing has been completed, disconnect the connection between the testing leads and the circuit under test and remove testing leads from the input terminals.

E. Frequency Measurement (see figure 7)

⚠ Warning

To avoid harms to you or damages to the Meter from electric shock, do not attempt to measure voltages higher than 600V AC/DC, although readings may be obtained.



(figure 7)

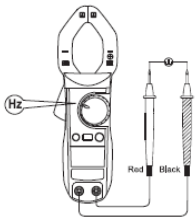
The resistance ranges are:
10Hz, 100Hz, 1kHz, 10kHz, 100kHz, 1MHz and 10MHz.
To measure frequency, connect the Meter as follows:

1. Insert the red temperature probe into the Hz Duty% terminal and the black temperature probe into the COM terminal.
2. Set the rotary switch to Hz.
3. Connect the test leads across with the object being test. The measured value shows on the display.

Note

- When frequency measurement has been completed, disconnect the connection between testing leads and the circuit under test, and remove testing leads away from the input terminals.

F. Duty Cycle Measurement (see figure 8)



(figure 8)

⚠ Warning

To avoid harms to you or damages to the Meter from electric shock, do not attempt to measure voltages higher than 600V AC/DC, although reading may be obtained.

The duty cycle range is: 0.1% ~99.9%.

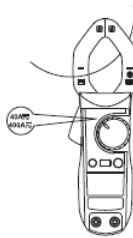
To measure duty cycle, connect the Meter as follows:

1. Insert the red temperature probe into the Hz Duty% terminal and the black temperature probe into the COM terminal.
2. Set the rotary switch to Hz and press RELA to select Duty Cycle measurement mode.
3. Connect the test leads across with the object being measured. The measured value shows on the display.

Note

- When duty cycle measurement has been completed, disconnect the connection between the testing leads and the circuit under test, and remove the testing leads away from the input terminals of the Meter.

G DC/AC Current Measurement (see figure 9)


(figure 9)

The measurement ranges of current are: 40.00 A≂ and 400.0 A≂

To measure current, do the following:

1. Set the rotary switch to 40 A≂ or 400 A≂. DC measurement mode is a default. Presses SELECT to switch between DC and AC measurement mode.
2. Hold the Meter tight, don't release. The Hall components are very sensitive not only to the magnet but also to heat and machines reaction force. Any shock will cause the changing in reading in the short time.

3. Press the lever to open the transformer jaw.
4. Center the conductor within the transformer jaw, then release the Meter slowly until the transformer jaw is completely closed, Make sure the conductor to be tested is placed at the center of the transformer jaw, otherwise it will cause deviation. The Meter can only measure one conductor at a time, to measure more than one conductor at a time will cause deviation.

Note

- Press RELA to subtracts a stored value from the present measurement value and displays a result.
- When current measurement has been completed, disconnect the connection between the conductor under test and the jaw, and remove the conductor away from the transformer jaw of the Meter.

Sleep Mode

To preserve battery life, the Meter automatically turns off if you do not turn the rotary switch or press any button for around 15 minutes.

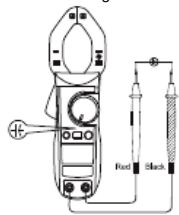
The Meter can be activated by turning the rotary switch or pressing the button based on 'The Effectiveness of Functional Buttons" on page 14. Press SELECT to activate the Meter will disable the Sleep Mode feature.

The Meter beeps 5 times in about 1 minute before entering Sleep Mode and it will have a 1 long beep just before entering Sleep Mode.

To disable the Sleep Mode function, press and hold SELECT button while turning on the Meter.

H. Capacitance measurement (see figure 10)

figure 10



⚠ Warning

To avoid damage to the Meter or to the equipment under test, disconnect circuit power and discharge all high-voltage capacitors before measuring capacitance. Use the DC voltage function to confirm that the capacitor is discharged.

The Meter's capacitance ranges arc: 40.00nF. 400.0nF, 4.000uF, 40.00uF, and 100.0μF. To measure capacitance, connect the Meter as follows:

1. Insert the red test lead into the HzV Ω terminal and the black test lead into the COM terminal.
2. Set the rotary switch to ⊣⊢.
3. Connect the test leads across with the object being measured. The measured value shows on the display.

Note

- For testing the capacitor with polarity, connect the red clip to anode & black clip to cathode instead of using test leads as mentioned above.
- To minimize the effect of capacitance stored in the test leads, the test lead should be as short as possible. To measure a small value of capacitance, use REL mode to remove the leads capacitance. Remaining voltage, insulated impedance & dielectric absorption from the capacitor may cause the measurement error.
- It takes a longer time when testing a high capacitor value, the testing time is around 15 seconds in 100uF range.
- The LCD displays OL indicating the tested capacitor is shorted or it exceeds the maximum range.
- When capacitance measurement has been completed, disconnect the connection between the testing leads and the circuit under test and remove the testing leads away from the input terminals of the Meter.

Specifications

A. General Specifications:

- Maximum Voltage between any Terminals and grounding: Refer to different range input protection voltage.
- Display: 3 3/4 digits LCD display, Maximum display 3999
- Polarity: Automatically display.
- Overloading: Display OL or -OL
- Battery Deficiency: Display
- Measurement Speed: Updates 3 times/second.
- Measurement Deviation: The conductor being measured is not placed in the center of the jaw during AC/DC current measurement, it will cause extra +1 % deviation based on the stated accuracy.
- Max. Jaw Size: 30mm diameter.
- Projected Max. Current conductor size: 30mm diameter.
- Electro-Magnetic: When carrying out measurement near the electro-magnetic, it may cause unstable or wrong reading.
- Power: 3x1.5V battery (AAA) (not included)
- Battery Life: typically 150hours (alkaline battery)
- Sleep Mode (can be disabled)
- Dimensions (H x W x 1): 203mm x 68mm x 33mm
- Weight: Approximate 235g (battery included)

B. Environmental Requirements

- The Meter is suitable for indoor use.
- Altitude: Operating: 2000m
- Storage: 1OOOOm
- Safety/ Compliances: IEC 61010 CAT.II 600V over voltage and double insulation standard.
- Temperature and humidity:
  Operating: O℃~30℃(~ 85%R.H);
  30℃~40℃ (~ 75%R.H);
  40℃~50℃ (~ 45%R.H);
  Storage: -20℃~+60℃ (~ 85%R.H)

Accurate Specifications

Accuracy: +(a% reading + b digits).
Operating temperature: 23℃±5℃
Relative humidity: (85%R.H)
Temperature coefficient: 0.1x (specified accuracy)1℃

A. DC Voltage

Range	Resolution	Accuracy	Overload protection
400.0mV	0.1mV	+(1 %+3)	600V DC/AC
4.000V	1mV	+(1 %+1)	
40.00V	10mV		
400.0V	100mV		
600V	1V	+ (1 %+5)	

Remarks: Input impedance: 10MΩ

B_ AC Voltage

Range	Resolution	Accuracy	Overload protection
4.000V	1mV	+ (1.2%+5)	600V DC/AC
40.00V	10mV		
400.0V	100mV		
600V	1V	+(1 .5 %+5)	

Remarks:

- Input impedance: 10MΩ// less than 100pF
- Frequency response: 40Hz-400Hz.
- Change to AC: Change to AC by using average response method. Input sine wave, then adjust the reading until it is same as the effective value.

C. Resistance

Range	Resolution	Accuracy	Overload protection
400.0Ω	100mΩ	+(1.2%+5)	600Vp
4.000kΩ	1Ω	+(1 %+5)	
40.00kΩ	10Ω		
400.0kΩ	10Ω		
4.000MΩ	1kΩ	+(1.2%+5)	
40.00MΩ	10kΩ	+(1.5%+5)	

D. Diode Test

Range	Resolution	Accuracy	Overload protection
	1mV	Display forward voltage drop nearest value	600Vp

Remark: Open circuit voltage approximate 1.48V.

E. Continuity Test

Range	resolution	accuracy	Overload protection
	100mΩ	Around≤50Ω The buzzer beeps	600Vp

Remark:
Open circuit voltage approximate 0.45V.

- The buzzer may or may not beeps when the resistance of a circuit under test is between 50Ω~1OOΩ
- The buzzer will not beep when the resistance of a circuit under test is > 1OOQ.

F. Frequency

Range	Resolution	Accuracy	Overload protection
10Hz	0.00Hz	+(0.1 %+5)	600Vp
100Hz	0.01Hz		
1kHz	0.1Hz		
10kHz	1Hz		
100kHz	10Hz		
1MHz	100Hz		
10MHz	1kHz	reference only	

Remark:
Input Sensitivity as follows:
When ≤ 100kHz: ≥ 300mV rms;
When > 100kHz: ≥ 600mV rms
When > 1MHz: ≥ 800mV rms

G. Duty Cycle

Range	Resolution	Accuracy	Overload protection
0.1 % ~99.9%	0.1 %	reference only	600Vp

H. DC Current

Range	Resolution	Accuracy	Overload protection
40.00A	0.01A	+(2.5%+5)	400A DC/AC
400.0A	0.1A	+(2.5%+3)	

⚠ Warning

The operating temperature must be 0℃~40℃ when measuring current.

Remark:

- If the reading is positive, the current direction is from bottom to up. See figure 10, the front case face up while the bottom case face down. Hold the Meter tight, do now release. The hall components are very sensitive not only to the magnet but also to heat and machines reaction force. Any shock will cause the changing in reading in the short time. Follow the below procedure to measure current will be more precise:

- Hold the Meter tight and press the lever to open the transformer jaw. Center the conductor within the transformer jaws, then release the Meter slowly until the transformer jaw is completely closed. Make sure the conductor to be tested is placed at the center of the transformer jaw, otherwise it will cause +1 .0% deviation based on the stated accuracy.
- Remove the transformer jaw.
- Press RELA to display zero.
- Repeat the above 1. procedure.
- The obtained reading will be more precise.

I. AC Current

Range	Resolu -tion	Accuracy	Frequency Response	Overload protection
40.00A	0.01A	+(3%+8)	50Hz ~ 60Hz	400A DC/AC
400.0A	0.1A	+(3%+5)		

⚠ Warning

The operating temperature must be O℃ ~40℃ when measuring current.

Remark:

- It may have 10 digits or less unstable or wrong digits, it will not affect measurement result.
- Hold the Meter tight, do now release. The Hall components are very sensitive not only to the magnet but also to heat and machines reaction force. Any shock will cause the changing in reading in the short time. Follow the below procedure to measure current will be more precise:
  1. Hold the Meter tight and press the lever to open the transformer jaw. Center the conductor within the transformer jaws, then release the Meter slowly until the transformer jaw is completely closed. Make sure the conductor to be tested is placed at the center of the transformer jaw, otherwise it will cause +1.0% deviation based on the stated accuracy.
  2. Remove the transformer jaw.
  3. Press RELA to display zero.
  4. Repeat the above 1. procedure.
  5. The obtained reading will be more precise.

●Change to AC:
Change to AC by using average response method. Input sine wave, then adjust the reading until it is same as the effective value.

J. Capacitance

Range	Resolution	Accuracy	Overload Protection
40nF	10pF	Measure at REL mode ±(5 %+1 0)	600Vp
400nF	100pF	±(5%+1 0)	
4uF	1nF		
40uF	10nF		
100uF	100nF	±(6%+10)	

MAINTENANCE
This section provides basic maintenance information including battery replacement instruction.

⚠Warning
Do not attempt to repair or service your Meter unless you are qualified to do so and have the relevant calibration, performance test, and service information
To avoid electrical shock or damage to the Meter, do not get water inside the case.
A. General Service
- Periodically wipe the case with a damp cloth and mild detergent. Do not use abrasives or solvents.
- To clean the terminals with cotton bar with detergent, as dirt or moisture in the terminals can affect readings.
- Turn the Meter power off when it is not in use.
- Take out the battery when it is not using for a long time.
- Do not use or store the Meter in a place of humidity, high temperature, explosive, inflammable and strong magnetic field.

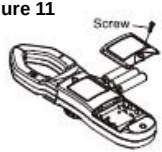
B. Replacing the Battery (see figure 11)

⚠ Warning

To avoid false readings, which could lead to possible electric shock or personal injury, replace the battery as soon as the battery indicator "🔋" appears. Make sure the transformer jaw and the test leads are disconnected from the circuit being tested before opening the case bottom.

To replace the battery:

figure 11



1. Turn the Meter off and remove all the connections from the input terminals
2. Turn the Meter's front case down.
3. Remove the screw from the battery compartment, and separate the battery compartment from the case bottom
4. Take out the old battery and replace with a new 9V battery
5. Rejoin the case bottom and the battery compartment, and reinstall the screw.

** END **

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